CLAIMS

We claim:

1. A fluid delivery device for use in minimally invasive surgical procedures comprising:

a tubular component having a distal end for insertion into a body cavity; and

a spray tip assembly having a diameter of at most about 12 mm and attached to the distal end of the medical tubing for discharging fluid into the body cavity, the spray tip assembly comprising:

a first mechanical breakup unit having at least one feed port configured to direct a fluid into a first spin chamber and issue into a first exit port; and

a second mechanical breakup unit positioned alongside the first mechanical breakup unit and having at least one feed port configured to direct a fluid into a second spin chamber and issue into a second exit port, wherein the first and second exit ports extend through the external surface of the spray tip.

2. The fluid delivery device according to claim 1, further comprising:

a first funneling portion adjacent the first spin chamber and having a sloped sidewall configured to direct the fluid issuing into the first exit port for discharging; and

a second funneling portion adjacent the second spin chamber and having a sloped sidewall configured to direct the fluid issuing into the second exit port for discharging.

3. The fluid delivery device according to claim 2, wherein the delivery device is dimensioned to produce a spray discharging from the first and second exit ports when fluids of different viscosities are fed into each mechanical breakup unit and a force of a single magnitude is used to propel fluid through the device.

4. The fluid delivery device according to claim 1, further comprising a first fluid source in fluid communication via the tubular component with at least one first feed conduit and a second fluid source in fluid communication via the tubular component with at least one second feed conduit, wherein the at least two conduits deliver fluid to different mechanical breakup units.

5. The fluid delivery device according to claim 4, wherein there are two first feed conduits for delivering fluid to the first mechanical breakup unit and two second feed conduits for delivering fluid to the second mechanical breakup unit.

6. The fluid delivery device according to claim 4, wherein there are three first feed conduits for delivering fluid to the first mechanical breakup unit and three second feed conduits for delivering fluid to the second mechanical breakup unit.

7. The fluid delivery device according to claim 4, wherein there are four first feed conduits for delivering fluid to the first mechanical breakup unit and four second feed conduits for delivering fluid to the second mechanical breakup unit.

8. The fluid delivery device according to claim 5, wherein the first and second feed conduits are adjacent and parallel to the first and second exit ports.

9. The fluid delivery device according to claim 4, wherein a fluid in each fluid source has a different viscosity.

10. The fluid delivery device according to claim 9, wherein the fluid of the first source is fibrinogen and the fluid of the second source is thrombin.

11. The fluid delivery device according to claim 3, wherein the spray is produced when fluid exits the device at a rate within the range of from approximately 0.4 to approximately 0.5 cc/second.

12. The fluid delivery device according to claim 3, wherein a resulting spray cone of one of said fluids has a width greater than a resulting spray cone of the other fluid.

13. The fluid delivery device according to claim 12, wherein the wider spray cone achieves circumjacent coverage over the narrow spray cone at a distance within the range of about 0.5 to about 2 inches from the exit ports.

14. The fluid delivery device according to claim 4, further comprising feed ports directing fluid from the feed conduits to the spin chamber of each mechanical breakup unit.

15. The fluid delivery device according to claim 14, wherein the feed ports of each mechanical breakup unit are oriented such that the first fluid is caused to spin in a direction opposite the second fluid within the spin chambers.

16. The fluid delivery device according to claim 2, wherein at least one additional conduit is positioned through the spray unit assembly.

17. The fluid delivery device according to claim 16, wherein the additional conduit is an optical fiber.

18. The fluid delivery device according to claim 1, wherein a diameter of the first spin chamber and a diameter of the second spin chamber are in the range of about 0.02 to about 0.06 inch.

19. The fluid delivery device according to claim 2, wherein the sloped sidewall of the first funneling portion defines an angle within the range of from about 60° to about 120°.

20. The fluid delivery device according to claim 19, wherein the defined angle is preferably within the range of from about 110° to about 120°.

21. The fluid delivery device according to claim 2, wherein the sloped sidewall of the second funneling portion defines an angle within the range of about 60° to about 120°.

22. The fluid delivery device according to claim 21, wherein the defined angle is preferably within the range of from about 90° to about 110°.

23. The fluid delivery device according to claim 1, wherein the width of the feed ports for each mechanical breakup unit is within the range of about 0.01 to about 0.02 inch.

24. The fluid delivery device according to claim 23, wherein the width of each feed port is preferably within the range of about 0.012 to about 0.016 inch.

25. The fluid delivery device according to claim 1, wherein the height of the feed ports for each mechanical breakup unit is within the range of about 0.004 to about 0.016 inch.

26. The fluid delivery device according to claim 25, wherein the height of each feed port is preferably within the range of about 0.009 to about 0.012 inch.

27. The fluid delivery device according to claim 1, wherein the diameter of the exit port for each mechanical breakup unit is within the range of about 0.004 to about 0.016 inch.

28. The fluid delivery device according to claim 27, wherein the diameter of the exit port is preferably within the range of about 0.008 to about 0.012 inch.

29. The fluid delivery device according to claim 1, wherein the length of the exit port for each mechanical breakup unit is within the range of about 0.004 to about 0.016 inch.

30. The fluid delivery device according to claim 29, wherein the length of the exit port is preferably within the range of about 0.006 to about 0.010 inch.

31. The fluid delivery device according to claim 1, wherein a ratio of the diameter of the spin chamber to the diameter of the exit port is within a range of from about 2 to about 6..

32. The fluid delivery device according to claim 1, wherein a ratio of the width of the feed port to the height of the feed port is within a range of from about 0.8 to about 1.6.

33. The fluid delivery device according to claim 1, wherein a ratio of the length of the exit port to the diameter of the exit port is within a range of from about 1.5 to about 3.0.

34. The fluid delivery device according to claim 1, wherein a ratio of the length of the spin chamber to the diameter of the exit port is within a range of from about 1.1 to about 1.5.

35. The fluid delivery device according to claim 1, wherein a ratio of the exit port length to the exit port diameter is within the range of about 0.25 to about 1.0.

36. The fluid delivery device according to claim 1, wherein the diameter of the spray tip assembly is about 10 mm.

37. The fluid delivery device according to claim 1, wherein the diameter of the spray tip assembly is about 5 mm.